EVALUATION OF POLYAROMATIC COMPOUND IN WATER TREATMENT PLANT AT BASRAH GOVERNORATES.

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ABSTRACT

Given the fact that drinking water is of great importance in human life and the need for this water within the specifications and special standards, as well as the emergence of many problems of drinking water pollution in different areas of Basrah. This study was conducted to demonstrate the validity of the drinking water produced from the following liquefaction stations (Labani ,Barda'ia and Basrah Unified Project Stations). The samples were collected in several stages (before treatment, filters, after treatment, housing). Therefore, total oil compounds and polyaromatic compounds were measured for water in these stations. Samples were collected quarterly for the period from autumn 2017 to summer 2018. Concentrations of total petroleum compounds ranged from (5.91-0.39 µg / L) in the study stations, And thus exceeded the limits allowed by the Iraqi specification No. (417) for the year 2001 (0.00001 µg / L) in all stations and seasons. The total concentration of PAHs in the study stations ranged from (ND - 1.22) ng / L, Although there are total PAHs concentrations, they did not exceed the limits allowed by WHO (2018) (100 ng / L) at all stations and seasons.

Keywords: PAHs; oil contamination; water treatment plant, Basrah .

Introduction:-

Fresh water is essential source of human life. The recent decline in fresh water and increased water pollution are inevitable problems that have a profound impact on peoples and the environment around the world [1]. Total hydrocarbons and polycyclic aromatic hydrocarbons are important contaminants that affect public health in urban areas, particularly in developing and oil countries [2]. The main source of hydrocarbon pollution in drinking water is coal tar or paint pipes in the public water supply system used to protect pipes from erosion [3]. The contamination of polycyclic aromatic hydrocarbons in the water system is of concern [4]. They are volatile organic pollutants everywhere because their presence in the environment is a global concern, some of which are carcinogenic and mutagenic [5]. A group of dangerous organic compounds consisting of two or more rings of gasoline, linked to linear, cluster or angular arrangements. Most of which are colored, white or pale yellow [6]. It is widely dispersed in water, air, soil, dust and sediment [7]. Enter the aquatic environment through city runoff, municipal and industrial effluents, or oil spill [3].

Materials and Methods:-

The study Area:

The study area included the stages of treatment in three liquefaction projects for the water of the city of Basra, and these projects are first water project Albbani, a project located in the district of Abi al-Khasib This project feeds the center of Abi al-Khasib district and the surrounding areas. Second, the project of Bardia and feed this project areas of Bredia, Algeria, Mashraq and Mtihh and Tmuz and Abbasiyah and Bariha. The unified Basra water project, which is located in the center of Basra City, The project is funded by Al-Haritha, Karma Ali, Al-Mithaq Street, 40% of the Republic and Al-Suma'i. Samples were collected from these stations in several stages (pre-treatment, filters, after treatment, housing). Water samples were collected quarterly for the period from autumn 2017 to the summer of 2018 of the study stations.

Chemical Properties:-

The method adopted by the United Nations Environment Program [8]was used to extract hydrocarbon oil from aquatic samples, The samples were collected with dark glass bottles (4 liters) and proved to be field-based using chloroform [8]. Total concentrations of hydrocarbons were measured using Spectroflouromete. While polycyclic aromatic hydrocarbons were measured by high-performance liquid chromatography.

Results and Discussion:-

The highest values of total oil compounds in water (5.91 µg / L) were recorded in the fall at the Labani station (before treatment) as shown in Table (1), this higher value may be that the Shatt al-Arab waters receive pollutants from several industrial sources, the most important of which are the oil refineries such as the Abadan refinery on the Iranian side and the Miftiyah on the Iraqi side [9]. The lowest (0.39 µg / L) was recorded in the spring at the Basrah Project

Station (Filters) Table (1) The decrease in the concentration of oil contaminants in the spring may be due to the collection of specimens after heavy rains, which led to a decrease in the water of the source (Shatt al-Arab). Total petroleum compounds in all stations and seasons exceeded the limits allowed by the Iraqi standard No. (417) for the year 2001[10] (0.00001 µg / L). The statistical analysis showed significant differences between the study stations (LSD p ≤0.05) and significant differences during the seasons (LSD p ≤ 0.05) and significant differences between the factors (LSD p ≤ 0.05) Table (1).

For Polycyclic Aromatic Hydrocarbon (PAHs), The results of the study showed that the concentration of total PAHs ranged from (1.23 ng / L) in the winter in the labani station (before treatment) as shown in Table (2b) To an insignificant in the summer at the station Albarqih (housing) Table (2d) In the spring in Bredia stations (Before treatment, after treatment) The unified Basra project (after treatment, housing) tabal(2c). The total PAHs concentrations in the water were more winter (Table 2b) Because the PAHs that are introduced to the environment are higher in winter than in the summer [9], The increase in burning of fuel, wood and coal is used to heat homes in winter, increase the deposition of suspended matter in the atmosphere, and the associated rainfall of vapors and suspended compounds into the aquatic environment [9,11]. The failure to record the total concentration of PAHs in the summer in the Bredia stations (housing) It is due to the warm climate of Iraq in summer, as high temperatures help evaporation of PAHs in water [12]. High temperatures also stimulate microorganisms to crack down on these compounds, especially low molecular weights [13], As well as optical oxidation processes that play an important role in our region because of the length of the sun's brightness and the intensity of solar radiation [14,15]. Non-registration of values for total PAHs concentration in the spring in the Bredia station (Pre-treatment, after treatment) and the unified Basrah project (after treatment, housing) tabal(2c), Possibly due to rain that leads to the source's water mitigation correspond to [16] As the rainfall is high in the spring, the dilution factor has an important role to play in reducing concentrations of aromatic petroleum compounds. Although there are total PAHs concentrations, they did not exceed the limits allowed by World Health Organization [17] (100 ng / L) at all stations and seasons.

Table (1): Site and Quarterly Changes of Total Petroleum Vehicles in Unit (µg / L)

seasons		Autumn 2017			Winter 2018			Spring 2018			Summer 2018		
Stages of sampling of stations		Labani Station	Al-Bara'ia Station	Station of the unified Basra project	Labani Station	Al-Bara'ia Station	Station of the unified Basra project	Labani Station	Al-Bara'ia Station	Station of the unified Basra project	Labani Station	Al-Bara'ia Station	Station of the unified Basra project
Before treatment	Mean	5.84	3.97	4.14	2.08	1.22	2.15	0.75	1.89	0.58	1.45	0.78	2.17
	Std. Deviation	0.06	0.02	0.02	0.01	0.01	1.00	0.20	0.10	0.09	0.10	0.01	0.01
	Minimum	5.80	3.95	4.12	2.07	1.21	1.15	0.55	1.79	0.49	1.35	0.77	2.16
	Maximum	**5.91**	3.98	4.16	2.09	1.23	3.15	0.95	1.99	0.67	1.55	0.79	2.18
Filters	Mean	2.56	3.97	4.51	1.08	1.16	1.81	2.60	2.43	0.46	1.01	0.93	1.11
	Std. Deviation	0.06	0.01	0.01	0.01	0.01	0.10	0.10	0.01	0.08	0.01	0.01	0.01
	Minimum	2.49	3.96	4.50	1.07	1.15	1.70	2.50	2.42	**0.39**	1.00	0.92	1.10
	Maximum	2.59	3.98	4.52	1.09	1.17	1.90	2.70	2.44	0.54	1.02	0.94	1.12
After treatment	Mean	1.07	3.91	3.20	1.54	1.71	0.98	1.42	0.73	1.34	0.74	0.67	1.26
	Std. Deviation	0.06	0.01	0.10	0.10	0.01	0.01	0.01	0.04	0.01	0.10	0.01	0.02
	Minimum	1.02	3.90	3.10	1.44	1.70	0.97	1.41	0.69	1.33	0.64	0.66	1.24
	Maximum	1.13	3.92	3.30	1.64	1.72	0.99	1.43	0.76	1.35	0.84	0.68	1.28
housing	Mean	1.47	1.67	2.68	1.23	1.07	0.80	1.59	0.71	0.97	1.33	0.81	0.76
	Std. Deviation	0.01	0.01	0.01	0.02	0.02	0.10	0.03	0.02	0.01	0.10	0.01	0.01
	Minimum	1.46	1.66	2.67	1.21	1.05	0.70	1.56	0.69	0.96	1.23	0.80	0.75
	Maximum	1.48	1.68	2.69	1.24	1.08	0.90	1.62	0.73	0.98	1.43	0.82	0.77
Stations (LSD p ≤ 0.05)		**0.73**			**Seasons (LSD p ≤ 0.05)**			**0.11**			**Factors (LSD p ≤ 0.05)**		**0.28**
The maximum allowed in Iraqi Standard No. (417)					**0.00001 µg/L**								

Table (2a) Quarterly and local changes of PAHs in the fall season (ng / l)

autumn season	Labani				Al-Bara'ia				The unified Basra project			
Aromatic compounds	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing
Acenaphthene	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Acenaphtylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND
Benzo[a]anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[a]pyrene	0.01	ND	ND	0.01	0.02	0.01	0.01	ND	ND	ND	ND	0.01
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	0.01	0.01	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	0.02	0.05	0.02	ND	ND	ND	ND	0.02	0.01	0.01	ND	ND
Benzo[k]fluoranthene	0.05	0.01	0.02	ND	0.02	0.01	0.01	ND	0.03	0.02	0.02	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo[a,h]anthracene	0.46	0.09	0.13	ND	0.40	ND	ND	0.01	0.30	0.17	0.14	0.04
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
indeno[1,2,3-c,d]pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphtalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Total PAHs	0.54	0.15	0.17	0.01	0.49	0.03	0.03	0.03	0.34	0.2	0.16	0.05
WHO (2018) with in Total PAHs for the maximum allowed						100 ng/L						

Table (2 b) Quarterly and local changes of PAHs in the winter season (ng / l)

winter season	Labani				Al-Bara'ia				The unified Basra project			
Aromatic compounds	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing
Acenaphthene	0.04	0.04	0.01	ND	0.02	0.02	ND	ND	ND	0.01	ND	0.04
Acenaphtylene	0.05	ND	0.04	0.11	ND	ND	ND	0.01	ND	ND	ND	0.01
Anthracene	0.86	0.71	0.16	0.26	0.02	ND	0.17	0.05	ND	0.01	0.08	0.16
Benzo[a]anthracene	0.02	ND	ND	0.01	0.01	ND	ND	ND	ND	0.01	ND	ND
Benzo[a]pyrene	ND	ND	ND	ND	ND	ND	0.01	ND	ND	0.01	0.01	0.01
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND
Benzo[g,h,i]perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	0.11	0.07	ND	ND	0.07	ND	0.02	0.01	0.02	0.03	0.01	0.01
Chrysene	0.02	0.01	ND	0.02	0.01	0.01	ND	ND	ND	ND	ND	0.01
Dibenzo[a,h]anthracene	ND	0.01	0.05	0.07	ND	ND	ND	0.01	0.06	0.02	ND	ND
Fluoranthene	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	0.09	0.18	0.04	0.01	0.05	0.07	0.03	ND	ND	0.02	0.02	0.01
indeno[1,2,3-c,d]pyrene	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND
Naphtalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.06	ND
Phenanthrene	0.01	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	0.02	0.05	ND	0.01	0.01	0.01	ND	ND	ND	ND	ND	0.01
Total PAHs	1.22	1.09	0.3	0.49	0.21	0.11	0.23	0.08	0.08	0.14	0.18	0.26
WHO (2018) with in Total PAHs for the maximum allowed							100 ng/L					

Table(2c): Quarterly and weekly changes of PAHs in the spring season (ng / l)

spring season	Labani				Al-Bara'ia				The unified Basra project			
Aromatic compounds	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphtylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[a]anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[a]pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo[a,h]anthracene	0.02	ND	0.06	0.33	ND	1.65	ND	0.25	ND	0.06	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
indeno[1,2,3-c,d]pyrene	ND	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphtalene	ND	ND	ND	ND	ND	0.04	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PAHs	0.02	0.09	0.06	0.33	ND	1.69	ND	0.25	ND	0.06	ND	ND
WHO (2018) with in Total PAHs for the maximum allowed						100 ng/L						

Table (2 D) Quarterly and local changes of PAHs in the summer season (ng /l)

summer season	Labani				Al-Bara'ia				The unified Basra project			
Aromatic compounds	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing	Before treatment	Filters	After treatment	housing
Acenaphthene	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphtylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	0.15	ND	0.19	0.21	0.23	0.21
Benzo[a]anthracene	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[a]pyrene	ND	ND	ND	ND	ND	ND	0.01	ND	ND	0.01	0.02	0.01
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	0.02	ND
Benzo[k]fluoranthene	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo[a,h]anthracene	ND	ND	0.12	0.05	0.09	0.05	0.09	ND	0.02	0.06	ND	0.02
Fluoranthene	0.01	ND	0.01	ND	ND	0.01	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
indeno[1,2,3-c,d]pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphtalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PAHs	0.01	0.02	0.13	0.1	0.09	0.06	0.27	ND	0.21	0.28	0.27	0.24
WHO (2018) with in Total PAHs for the maximum allowed					100 ng/L							

Conclusions

The study shows that the concentration of total petroleum compounds in all stations and seasons exceeded the limits allowed by Iraqi Standard No. 417 for 2001 (0.00001 µg / L), While there were total PAHs concentrations, they did not exceed the limits allowed by WHO (2018) (100 ng / L) at all stations and seasons.

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